

US EPA RECORDS CENTER REGION 5



557241

**HEALTH CONSULTATION
PIG'S EYE LANDFILL SITE
ST. PAUL, RAMSEY COUNTY, MINNESOTA
CERCLIS No. MND980609085**

December 14, 1993

**Prepared by:
Minnesota Department of Health
Under Cooperative Agreement with the
Agency For Toxic Substances And Disease Registry**

INTRODUCTION

The purpose of this Public Health consultation is to evaluate any known or potential human health hazards which are documented or can be predicted from site information available at this time for the Pig's Eye Landfill (the Site). To incorporate human health considerations into the developing site strategy, the U.S. Environmental Protection Agency (EPA) requested that the Agency for Toxic Substances and Disease Registry (ATSDR) prepare a health consultation on the Site. This consultation was prepared by the Minnesota Department of Health (MDH) under cooperative agreement with ATSDR using site-specific information obtained from ATSDR as a data package. Observations made during a visit of the Site and surrounding area by MDH and the Minnesota Pollution Control Agency (MPCA) on November 12, 1993 are included in this consultation document.

SITE BACKGROUND AND HISTORY

The Pig's Eye Site (the Site) is included on the Minnesota Superfund Permanent List of Priorities (PLP). It was added to the EPA's Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) inventory program at the MPCA in June 1981. This action was taken following reports of past disposal of industrial wastes including solvents, paint sludge, and unknown drummed wastes at the Site. The Site was placed on the PLP list in December of 1989.

The Site, formerly known as the St. Paul Landfill, is located within the city of St. Paul, Ramsey County, roughly three miles south-east of downtown St. Paul on the east side of the Mississippi River. The Site is bordered by a Soo Line rail yard to the north and east, by the main Twin Cities municipal waste-water treatment facility to the south, by Pig's Eye Lake to the south, and by Child's Road, railroad tracks, and industrial operations on its west side near the river.

The Site was operated by the city of St. Paul from the mid 1950s to 1972. Although called a landfill, the Site did not operate according to MPCA rules for a sanitary landfill--rules which were not yet in place while the Site was used. Therefore, the Site is more accurately described as a dump. Similarly, the inactive dump is technically in abandoned status, rather than a properly "closed" Site. The differences between these technical terms is important from a public health perspective because the dump was not lined to restrict leachate from contaminating groundwater, records of waste disposal were not maintained, hazardous wastes were not screened out, and a cover among other closure requirements is lacking.

The Site was occupied by small lakes and wetlands prior to disposal activities and as no liner was used under the dump, wastes were likely disposed directly into the wetlands which were then buried under waste and fill. The Site accepted mixed-municipal, commercial, and industrial wastes from St. Paul and the surrounding communities. Estimates of the waste volume deposited range between 8 and 27 million cubic yards. According to MPCA files, an

estimated volume of 1.7 million cubic yards of waste was accepted annually. The MPCA ordered the dump to shut down in July 1972.

Between 1977 and 1985, an estimated 435,000 cubic yards of sludge incinerator ash from the MWCC was disposed over 31 acres of the Site. This was permitted by the MPCA (number SW-189). The ash was spread 2 to 4 feet thick over the dump's surface. The ash was covered with a minimum of six inches of topsoil and seeded to provide cover. The ash originated from incineration of dewatered municipal wastewater sludge.

Physical Description

The Site is situated on an alluvial bar within a large flood plain of the Mississippi River. Its general elevation is 5 to 15 feet above the river and roughly 200 feet below the general land surface above the river valley and flood plain. In total, the abandoned dump occupies approximately 320 acres. The Site's surface has minimal relief, with a slight slope toward the southwest in the direction of Pig's Eye Lake.

The dump is on the bank of Pig's Eye Lake which is connected via a channel to the Mississippi River. A barge mooring area is located near where the lake and channel meet. This basin cover is roughly 15-acres in size and is sometimes referred to as Eagle or Hog Lake. One fork of Battle Creek flows through and adjacent to portions of the dump on its path to Pig's Eye Lake.

The Site is unfenced and generally accessible to the public. There is also evidence of human activities on the dump and in its immediate surroundings. The city of St. Paul operates a wood chipping facility on the western portion of the Site. The dump wastes, aside from the area used for ash disposal, are generally not covered except with intermixed fill. Much of the site is heavily vegetated, despite the lack of a cover.

Geology and Hydrology

In general terms, the surficial geology beneath the Site consists of unconsolidated glacial drift which acts as a shallow aquifer. The drift deposits are heterogeneous consisting of intermixed lenses of sand, silt, clay, organic muck and peat. Roughly 10 to 25 feet of waste and fill were deposited atop the drift; however, the deposition in wetland areas and the reworking of the wastes over time has made it difficult to determine the depth of fill.

Beneath the drift, bedrock consists of the Prairie du Chien Sandstone overlying the Jordan Sandstone. The upper surface of bedrock varies from east to west, from 20 to 100 feet below ground. This is due to buried river channels which cut into the bedrock. Because there are no known confining layers in this sequence below the Site, the drift and upper bedrock aquifers (to the depth of the Jordan Formation) are considered to be connected, functioning as one aquifer. Beneath the Jordan Formation, lies the St. Lawrence Shale layer which acts as a

continuous confining layer that slows or prevents downward groundwater movement into the aquifers below it.

The Mississippi is the predominant factor influencing both surface water and groundwater at the Site. During flood periods or high water events, Pig's Eye Lake can receive water from the River via the interconnecting channel. The surrounding lowlands, including the dump, can be flooded. The latest major event occurred in 1993 during which much of the site was inundated. The Site was completely under water during the floods of 1965.

Drainage for most of the Site should be internal due to its flat topography with water collecting in the ungraded low lying areas. Some surface runoff may also drain to Battle Creek, the wetland fringe north of Pig's Eye Lake, or to other off-site areas. Runoff and groundwater which discharge to the creek eventually discharge to the lake. Battle Creek is the primary source of inflow to Pig's Eye Lake, although flow is only 1 to 10 cubic feet per second (cfs). The lake discharges to the Mississippi 2 to 3 miles south of the Site. The lake covers several hundred acres (size varies with the stage of the Mississippi River) and much of its shoreline is marshy wetland. The lake, in turn, discharges to the Mississippi River at 1 to 10 cfs. The average annual flow of the river is greater than 11,000 cfs near the Site.

Because the Site is surrounded on at least two sides by surface water, groundwater beneath the buried waste is directly influenced by changes in the water levels of these large surface bodies. The water table (uppermost surface of groundwater) beneath the Site is encountered at depths from 5 to 15 feet below ground. The movement of this groundwater is strongly connected to the Mississippi River, because both the drift and the upper sandstone bedrock aquifers discharge into the river ultimately. Flow in the surficial aquifer may also discharge to surface water such as Battle Creek, wetland areas, and Pig's Eye Lake which are all interconnected with each other and the river. On a localized scale, groundwater direction may reverse temporarily at high or flooding river stages, but the overall trend is expected to be toward the Mississippi.

Site Usage

There is evidence that people enter the site for various reasons and activities. As noted earlier, the Site is unfenced and accessible to the public from Child's Road. Small unpaved roads cross many areas of the dump's surface. The only active operation currently at the Site is the wood chipping facility on the western side along Child's Road where between 5 and 10 workers are employed. There is also evidence of recent human activities on the dump and in its immediate surroundings. During the November Site visit, MDH and MPCA staff noted the following: signs of trash dumping, vehicle tracks on many portions of the dump itself, disturbed soils from earth moving activities (purpose and party unknown), the remains of a soil revival demonstration project, work on the newly resurfaced Child's Road, and the operations at the wood chipping facility. During 1989 activities, MPCA staff noted evidence of transients living on the Site.

Review of Site Contamination

Past investigations of the Site include a Preliminary Assessment in 1983, a Screening Site Inspection in 1988-9, and an Expanded Site Inspection in 1992. The first assessment was performed by Ecology and Environment, Incorporated, and the latter two efforts were undertaken by staff of the MPCA. All specific contaminant information used in this consultation were obtained from reports of these investigations.

Field work during the 1988-9 Screening Site Investigation included sampling soil, groundwater, surface water, and one residential well. Results showed various solvents, hydrocarbons, polyaromatic hydrocarbons, and metals were present in Site-related media. Soil samples revealed organic compounds such as pesticides, naphthas, anthrenes, and phthalates in soil samples from borings and drilling work. The highest contamination was found along the southern border area of the dump.

Soil borings showed waste and fill materials are in contact with wetland deposits that predated the dumping. Because the dump was not lined and wastes were placed directly into wetland areas, contamination of shallow groundwater beneath the landfill and downgradient from the Site is likely. Monitoring results from site investigations by the MPCA have shown elevated levels of metals and various organic compounds.

Contaminants at the Site appear to have also reached surface waters of Battle Creek and Pig's Eye Lake, either via groundwater discharge or runoff from the site's surface. Signs of erosion are visible on the banks of Battle Creek and Pig's Eye Lake. This erosion has exposed waste materials in the fill and clearly shows that runoff from dump areas enters the surface waters. During past site inspections, MPCA staff reported visible leachate seeps from the landfill edge along Battle Creek and Pig's Eye Lake. Reports from 1992 surveys, noted suspected leachate reaching the creek in an area near the disposed sludge incinerator ash. Discolored (reddish) ice was seen in the same area during the November 1993 visit.

In 1992, MPCA collected sediment samples from Pig's Eye Lake and Battle Creek. Volatile and semi-volatile chemicals and metals were found in the samples above background levels.

During the 1992 Expanded Site Investigation, three soil samples were also collected from the top foot of material in the ash-disposal area--these were taken from what visibly appeared to be ash material. Analyses of the samples confirmed the high metals content of the ash consistent with MWCC ash analyses. This included high concentrations of cadmium, chromium, copper, lead, and nickel. Characterization tests on the ash, also showed that it had a high pH due to treatment of the sludge with basic chemicals.

Other than a general idea where the Site's boundaries are likely to be, there is very little reliable operational history or specific information about what wastes (especially potentially hazardous materials) were disposed at the Site, how much was disposed, and where. In

contrast, the area used for ash disposal is easily identifiable from its elevation and the composition of the ash was fairly well documented by MWCC.

Fires have occurred at the Site during its operations and after closure, the most recent known incident was in 1988 during which the dump burned intermittently for approximately two months. Such events suggest that high levels of methane may become trapped in pockets of the fill materials. The origin of methane is likely decomposing refuse and possibly some from decaying organic matter buried in the swamp deposits.

Chemicals of Concern

It is not possible to know whether all chemicals that should be considered of health concern have been identified at this point. This uncertainty exists because there appears to be little or no information about what specific chemicals are present in, or may be released later to, the various site-related media. For example, if potentially hazardous chemicals were disposed in the northern portion of the Site, they may not yet have impacted groundwater near the monitoring wells which are all located near the south end of the Site. Similarly, if wastes were disposed in containers which are still intact, the contents may not be released until some unknown future time. Consequently, some consideration must be given to the fact that currently undetected chemicals may pose threats in the future.

Despite the above data limitations, there are some data available for the soil, groundwater, and surface water. The data were provided in site sampling results reported in MPCA documentation of site investigations. Additional information is available in MPCA files concerning the locations, times, and methods for sampling which corresponds with the results shown below.

Groundwater

The maximum levels of organic chemicals and metals found in groundwater are shown in Table 1. If a Recommended Allowable Limit (RAL) exists for the compound, that value is given. The RALs are health-based guidelines designed to be protective for regular daily water consumption and contact during other household uses. Values marked by a J are considered to be estimates which are possibly biased high, or above the actual concentration in the sample. Additional notation is explained in the following paragraphs.

The MDH considers the following polycyclic aromatic hydrocarbons (PAHs) to be carcinogenic. This list was taken from the National Toxicology Program's 5th Annual Report on Carcinogens, 1989 Summary.

Benz(a)anthracene	Benzo(b)fluoranthene	7H-Dibenzo(c,g)carbazole
Benzo(j)fluoranthene	Benzo(k)fluoranthene	Dibenzo(a,e)pyrene
Benzo(a)pyrene	Dibenz(a,h)acridine	Dibenzo(a,i)pyrene
Dibenz(a,j)acridine	Dibenz(a,h)anthracene	Dibenzo(a,l)pyrene
Indeno(1,2,3-cd)pyrene	5-methylchrysene	

The RAL for all of the above-listed carcinogenic PAHs is 0.03 µg/L for the total of all carcinogenic PAHs (c-PAHs) detected in the sample. The RAL for any PAHs which do not appear in the list of carcinogenic PAHs and for which a RAL is not given in the preceding Table is 0.3 µg/L for the total of all such noncarcinogenic PAHs (nc-PAHs) in the sample.

Surface Water

Those compounds detected in surface water samples collected from either Battle Creek or Pig's Eye Lake are listed in Table 2. These are maximum levels found. Several of the results are qualified as estimated (denoted by a B or J) following a QA/QC audit of data by MPCA.

Soil

Table 3 gives the maximum levels of compounds detected in grab samples of soil at various depths. Several are qualified as estimated (denoted by a B or J).

Soil Gas

During soil sampling and well installation in 1989, soil samples were screened for volatile organic compounds with an organic vapor analyzer (OVA). Levels of up to 1,000 parts per million organic vapors (unspecified and possibly methane) were measured during drilling and boring activities.

DISCUSSION

Health-based comparison values for the compounds detected in soil and surface water are not relevant given the considerable uncertainties about future releases, contaminant migration, and the adequacy of monitoring used thus far to produce the available data.

Many of the compounds in the soil are also found in the groundwater samples, indicating that contaminants in the fill, the ash, and possibly in the aquifer material itself or from other sources are being leached into the groundwater.

Several of the contaminants detected in sampling thus far are known to bioaccumulate and may also be biomagnified in the food web. If one meal of fish per week is assumed (year-round consumption) to be taken from a contaminated body, MDH has calculated acceptable levels of several metals in fish tissue. Among those, antimony, inorganic arsenic, cadmium,

chromium VI, lead, and thallium have acceptable fish levels of less than 10 µg/g of edible tissue. This suggests that if mobilized and taken up by fish to any great extent, these metals may be the most important in terms of potentially presenting health risks.

In addition to the Pig's Eye dump, other activities in the area are also likely sources of contaminants to the local environment. These include unauthorized dumping at the Site, operations or accidents at the Railroad Yards, vehicular traffic on area roadways, and the various petroleum and industrial molasses storage and loading facilities along the adjoining bank of the Mississippi River. Another old dump, the Fish Hatchery Dump, is located just to the north of the Pig's Eye Site.

Exposure Pathways of Concern

In order for site-related contaminants to pose a health threat, people must be exposed to the chemicals. This means that the chemical(s) must be in a medium, such as air, soil, or water, that people have contact with. Contact can mean that people touch, breathe, or swallow the chemical or contaminated medium. People can also be exposed to chemicals in more than one medium. This exposure pathways section combines information presented in the Site Usage and Site Contamination sections of this consultation.

- People present at the Site may directly contact unburied waste or leachate (liquid from the dump) coming to the surface. Although much of the dump's surface is heavily vegetated, there are also areas where wastes have become exposed by erosion. Activities that disturb the fill materials such as digging, drilling, or the earth moving can also result in people contacting buried contaminants which would not otherwise be accessible. If contaminants bound to particulate matter become entrained in dry and blowing dusts, people can also be exposed by breathing the dust particles.

The only active operation currently at the Site is the wood chipping facility on the western side along Child's Road more than 200 feet from the area used for ash disposal. Between 5 and 10 workers are believed to be employed at this operation. Other people having regular access to the area around the Site include workers at the MWCC sewage treatment plant, railroad workers, or others employed at the remaining industries in that area. However, there is no information which suggests that any of these workers are involved in activities which require them to have direct contact with potentially contaminated site media. Trenching for MWCC lines through the Site and road construction or maintenance may also result in people being exposed to soil contaminants. The importance of such potential exposure depends on many factors which are unknown or unpredictable at this time.

The greatest possibility of direct contact with buried or exposed site contaminants seems to be for unauthorized activities, such as the earth moving evident during the site visit. Again, no information is available regarding the presence or levels of contaminants in areas involved or for the nature of the activities themselves. Therefore, it cannot be concluded at this time whether health concerns exist or not from this type of activity.

- The Site and surroundings harbor considerable wildlife--some which may be used by people as food. There has been visible evidence and reports from the Minnesota Department of Natural Resources of recreational fishing in both Battle Creek and Pig's Eye Lake at and south of the Site. The Site is also within the Mississippi National River and Recreation Area and the river is used extensively both commercially and recreational. Public activities include boating and fishing on the river and in adjacent wetlands. There are no drinking water intakes from the Mississippi River known within 15 miles downstream from the Site.

Information provided by Minnesota Department of Natural Resources (DNR) staff familiar with the area around the Site suggests that Pigs Eye Lake is not suitable for fishing near the dump's end of the lake. The lake is reportedly too shallow for boat traffic, except near the area where it is intercepted by the channel leading to the Mississippi River. In this area which is sometimes referred to as Eagle or Hog Lake, fishing pressure is reportedly heavy. More information on the fishing in this area and the nearby Mississippi was collected in a recent DNR creel survey. Data from this survey is forthcoming. The Mississippi is also a popular fishing area according to DNR. A shore fishing facility was recently completed on the Mississippi below the South Saint Paul Bridge, which is located downstream of the Site area.

If contaminants reaching the creek, lake, or river accumulate in sediments or food chain organisms, people consuming wildlife from these surface waters may also be exposed to contaminants that accumulate in living organisms, especially the tissues which are eaten. Several of the chemicals found at the Site are known to bioaccumulate in aquatic organisms, including fish. This may be a health concern if subsistence fishers regularly eat contaminated fish species or other edible biota from these waters.

- St. Paul city records have shown private residential wells exist within three miles of the Site. These may be screened in the shallow drift aquifers which are contaminated at the Site. The closest residential development near the Site is an area roughly 1/4 to 1/2 mile to the east and appears to be upgradient in terms of groundwater movement. One residential well, located approximately 1/4 mile to the east of the Site was sampled by MPCA to provide a background measurement of groundwater quality. A sample from this well did not contain elevated levels of the contaminants found at the Site. A single unknown heterocyclic amine was found in the well's sample, but this compound did not appear in any of the samples related to the Site. This preliminary data and the general understanding of groundwater movement in the area suggest that contamination of the nearest private wells above the flood plain is unlikely.

The cities of Oakdale and Woodbury both have municipal wells screened in the Jordan aquifer, but this is only an issue of concern if the wells are located in the area where groundwater is expected to become contaminated by the Site. The communities of Oakdale and Woodbury are located northeast and east of the Site respectively, seemingly upgradient from the Site. Based upon their probable locations, it appears unlikely that site contaminants would reach these municipal wells. Furthermore, municipal water systems are tested on a

regular schedule for contamination, unlike private wells. Therefore, if contamination should reach a municipal well at levels of health concern, its presence is likely to be recognized.

Groundwater is also used in the general area of the Site for commercial and industrial purposes according to MPCA reports; however, the location of wells is not given. If any of these wells are used for drinking water or other household uses and could intercept contaminants, then the users may be exposed to contaminants via ingestion, skin contact, and inhalation of volatile chemicals. The likelihood of contaminants reaching any area wells at levels of health concern, depends greatly on the locations and depths of any such wells and the extent of affected groundwater.

CONCLUSIONS

1. Contaminants are leaching from the wastes placed in the dump and have contaminated shallow groundwater beneath the Site rendering it unsafe for potable use as shown by the many sample concentrations over RALs. The full extent of contaminated groundwater is not known either in terms of area or depth.
2. The short- and long-term disposition of groundwater moving beneath the Site suggests that if contaminants in the groundwater have any significant impact on the local environment, their effect will likely be upon Pig's Eye Lake and the Mississippi River. The extent to which Site-related contaminants currently, or may in the future, affect the quality of the lake or river is not known.
3. It is possible, but currently unknown, if hazardous compounds are exposed at the Site's surface where people may contact them. The ash deposits are covered with topsoil and are vegetated which should prevent direct contact or blowing of the ash.
4. Fire potential at the Site is a safety concern due to the possibility of combustible wastes and potentially flammable and/or explosive levels of methane being ignited. The likelihood that emanating gases pose an inhalation or asphyxiation hazard is probably low because there are no enclosed structures on the Site where gases might accumulate. Off-site migration or accumulation of flammable gases has not been explored.
5. Although water levels on the river are typically controlled by dams and the flood control dikes near Child's Road probably reduce the potential for small-scale floods to cover the Site, the full impact of flooding on contaminant movement or the stability of the dump contents is not understood at this time. While flooding threatens to mobilize contaminants and accelerate their movement to off-site areas, it may also have the beneficial effect of periodically washing out and diluting contaminants in soils, groundwater, and surface bodies.
6. Three possible pathways for human contact with Site contaminants are identified; direct contact with site contaminants, potable use of contaminated groundwater, and by eating wildlife that may take up contaminants. The importance of these potential pathways are

unknown due to data gaps and lack of information about activities and resource use. From the little sampling data available, it appears that the possible health risks to people are most likely limited to any activities that might involve frequent and regular contact with contaminated media.

RECOMMENDATIONS

1. Additional information about hazardous materials allegedly dumped at the Site is needed to help determine if available Site characterization adequately describes the extent of contamination and to predict contaminant movement in the future.
2. Open access to the Site should be controlled to prevent unauthorized digging by persons who may not be trained to handle hazardous contaminants or who may not be aware of materials that could be encountered. Activities such as digging or earth moving should be prohibited unless workers are properly protected and trained in personal protection. Workers performing such tasks at the Site should be prepared to encounter physical and chemical hazards when unearthing potentially hazardous materials.
3. Drilling and boring at the Site should be accompanied by measures to detect explosive hazards due to trapped pockets of landfill gases.
4. The extent of groundwater contaminated by the Site should be estimated from available hydrogeologic data and monitoring results. Where further sampling may be warranted, MDH recommends a focus on any points of groundwater use that may become contaminated. Specifically, once the area(s) of groundwater contamination are known (both current and future), any wells which are likely to be contaminated above the level of the RALs should be identified and tested if they are used for human consumption.
5. The impact of site-related contaminants on Battle Creek, Pig's Eye Lake, surface water on the dump, and wetlands associated with these surface bodies should be assessed. Any impacts upon these resources and area wildlife should be determined as they relate to human consumption, especially through subsistence fishing. In addition, anglers who eat fish taken from the area, should be made aware of and advised to follow the guidance given in the Minnesota Fish Consumption Advisory booklet for Pig's Eye Lake and the Mississippi River.

CERTIFICATION

This Pig's Eye Landfill Health Consultation was prepared by the Minnesota Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.



Richard R. Kauffman, M.S.

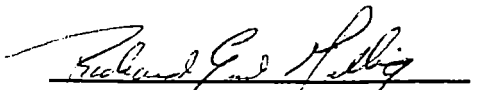
Technical Project Officer

Remedial Programs Branch (RPB)

Division of Health Assessment and Consultation (DHAC)

ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this health consultation, and concurs with its findings.


Sharon Williams-Fleetwood, Ph.D.
Chief, RPB, DHAC, ATSDR

REFERENCES

Ecology and Environment, Inc. 1983. Preliminary Assessment Report: Minnesota/TDD#R5-8212-04A, 05-MN-0055 St. Paul/Pig's Eye Landfill MND980609085

EPA. 1981. Potential Hazardous Waste Site: Site Inspection Report. Pig' Eye Landfill MN 0980609085.

MDH. 1991. Recommended Allowable Limits for Drinking Water Contaminants. Release No. 3.

MPCA. 1989. Screening Site Inspection Report for Pig's Eye Landfill; St. Paul, Minnesota, U.S. EPA ID#: MND980609085.

MPCA. 1992. Expanded Site Inspection Report for Pig's Eye Landfill; St. Paul, Minnesota, U.S. EPA ID#: MND980609085.

Personal communication with Mr. Jeff Gorton of the Minnesota Department of Natural Resources Fisheries Department. 11/29/93.

Table 1. Groundwater -- Maximum Contaminant Measurements

Parameter	Concentration (µg/L)	RAL
Benzene	21	10
Chlorobenzene	7	100
Methylene chloride	1900	50
1,2-Dichlorobenzene	23	600
1,4-Dichlorobenzene	29 J	10
Xylenes	95 J	10000
Toluene	22 J	1000
Phenol	2 J	4000
4-Methylphenol	52 J	---
Diethylphthalate	10	6000
2-Methylnaphthalene	21	---
di-n-Butylphthalate	3 J	700
Butylbenzylphthalate	2 J	100
Benzoic acid	35 J	30000
Nitrobenzene	9 J	3
2,4-Dimethylphenol	9 J	600
Naphthalene	27	30
Phenanthrene	14	nc-PAH
Pyrene	6 J	200
Chrysene	4 J	c-PAH
Benzo(b)fluoranthene	4 J	c-PAH
Fluoranthene	8 J	300
Fluorene	3 J	300
Benzo(a)anthracene	3 J	c-PAH
Acenaphthene	3 J	4000
4,4-DDD	6	---
Heptachlor epoxide	0.11	0.04
Dieldrin	0.35 J	0.02
Arochlor-1016	230	---
Antimony	106 J	2
Arsenic	194	0.2
Barium	8290 J	2000
Cadmium	380	4
Chromium	1600	100
Cobalt	674	2
Copper	4550 J	1000
Mercury	130	2
Nickel	974 J	100
Manganese	12700	600
Lead	18400 J	20
Vanadium	372	40
Cyanide	110	100

Table 2. Surface Water -- Maximum Contaminant Measurements

Parameter	Concentration (µg/L)
Acetone	40
Methylene chloride	2 J
Ethylbenzene	2 J
Styrene	4 J
di-n-Octylphthalate	3 J
Arsenic	3.4 BJ
Barium	8290 J
Copper	12.6 BJ
Manganese	462
Lead	4 BJ
Vanadium	972000

Table 3. Soil -- Maximum Contaminant Measurements

Parameter	Concentration
1,4-Dichlorobenzene	330 J $\mu\text{g/kg}$
Xylenes	6 J $\mu\text{g/kg}$
Methylene chloride	7 J $\mu\text{g/kg}$
2-Butanone	17 J $\mu\text{g/kg}$
Naphthalene	170 J $\mu\text{g/kg}$
2-Methylnaphthalene	130 J $\mu\text{g/kg}$
Phenanthrene	140 J $\mu\text{g/kg}$
Pyrene	160 J $\mu\text{g/kg}$
Chrysene	88 J $\mu\text{g/kg}$
Benzo(b)fluoranthene	130 J $\mu\text{g/kg}$
Benzo(a)anthracene	70 J $\mu\text{g/kg}$
Benzo(a)pyrene	99 J $\mu\text{g/kg}$
4,4-DDT	150 $\mu\text{g/kg}$
4,4-DDD	150 $\mu\text{g/kg}$
Heptachlor epoxide	8.3 J $\mu\text{g/kg}$
Dieldrin	2.4 J $\mu\text{g/kg}$
Endrin ketone	39 $\mu\text{g/kg}$
di-2-Ethylhexylphthalate	5900 $\mu\text{g/kg}$
di-n-Butylphthalate	99 J $\mu\text{g/kg}$
Butylbenzylphthalate	67 J $\mu\text{g/kg}$
Antimony	41 B mg/kg
Arsenic	4.8 J mg/kg
Cadmium	2 mg/kg
Chromium	24.2 mg/kg
Cobalt	11.1 mg/kg
Beryllium	0.8 B mg/kg
Mercury	0.3 mg/kg
Copper	23.5 mg/kg
Nickel	34.4 mg/kg
Manganese	3270 mg/kg
Lead	57 J mg/kg
Selenium	1.5 J mg/kg
Vanadium	33 mg/kg